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Eight species previously described, but not then known from Florida, complete the 38 additions, more than doubling the list. The names of 12 others have been changed through the recognition of the Florida phase of wide-ranging species as subspecifically distinct from the species formerly recorded as Floridian, so that the total number of new forms from Florida and the coast region of Georgia described, with two exceptions since 1888, is 42, out of a total of 73. Excepting among the bats, nearly all of the old species have been split into one or more subspecies, while the representatives of some of the genera have greatly increased. For example, *Geomys* (pocket gophers or "salamanders") has increased from 1 species to 4, with an additional subspecies; *Peromyscus* (deer-mice), from 3 species to 8 species and 3 additional subspecies.

Some of the subspecies recognized by Mr. Bangs are only very slightly differentiated local forms, so slightly that the advisability of their recognition in nomenclature is, to say the least, in some instances doubtful.

Mr. Bangs's paper is an important contribution to North American mammalogy, and is of especial value as a contribution to the faunal literature of a peculiarly instructive and interesting region.

J. A. A.

**Frog Biography.** — That most useful animal, the frog, has been so thoroughly discussed in such works as those of Ecker, Marshall, and Morgan, that it might seem at first sight as if there were nothing more to be said beyond the completion of anatomical and embryological details.

The first of a series of natural history notes<sup>1</sup> made upon Amphibia by H. Fischer-Sigwart, presents so much of interest in the life history of the frog, *Rana fusca*, that we wait eagerly for more, and, at the same time, venture to hope that some American representative of this group may soon meet with as sympathetic a biographer.

The author's observations extend over a period of some thirty years; the past ten years furnishing continuous data of times and seasons and measurements, made in the field and in his "terrarium," and now collected in tables. These and the double-page plate (the artistic merit of which must be seen to be appreciated) may be passed by to begin a brief synopsis of some of the facts recorded.

Scattered over the country, far from the water, the frogs of this species pass the summer in feeding, being most active by night and

<sup>1</sup> *Vierteljahrsschrift d. Naturfor. Gesell. in Zürich*, January, 1898, pp. 238-313.

lying concealed by day. After the middle of summer their appetites grow less keen, and as autumn comes on they begin to leave the special hunting fields that each has held for itself, and to migrate, singly, toward the ponds and lakes. It is, however, only the sexually mature animals, four or five or more years of age, that thus migrate; the young ones remain. The adults pass the winter concealed about the shores or in the mud at the bottom of the ponds, and awake from the dormant state when the early spring thaws out the ice. This occurs in March or February in the lowlands, but high in the mountains perhaps not until the middle of summer.

The awakened frogs congregate in great numbers and fall an easy prey to the greatest of all their numerous enemies, man; before they were decimated by wholesale slaughter at this, their breeding season, a single fisherman might take 1500 frogs in a single day.

The males, which we infer are much more numerous than the females, clasp the females and passively suffer themselves to be carried about in the water, or even upon land, for several days — three to thirty, in different places and seasons. Whether the males use their vocal organs to produce their “purring” noise or not seems to depend upon the temperature, and their use in warm weather indicates, the author thinks, a cat-like state of content. In cold seasons these sounds may not be heard, though breeding continues as usual.

The actual spawning is accompanied by a maximum of excitement when the females, covered by a struggling mass of males, sink to the bottom of the ponds and there deposit their eggs. Each egg is  $1\frac{1}{2}$  to 2 mm. in diameter, black above and white below, and enveloped in a lump of jelly 4 mm. in diameter. The eggs deposited by a female form a cluster about as large as a hen’s egg, and these clusters stick together so that a gelatinous layer may be formed on the bottom of the pond, extending, in some cases, as a band a meter wide all along the shore.

This breeding season lasts on the average 134 days, from the first awakening to the completion of spawning, and during that time the frogs take no food — unless, sometimes, their skins! The skin comes off in shreds, in the water, at this season, and is shed again three times during the year. In these moltings the animal may eat its own skin.

When the eggs are laid and fertilized, the frogs all leave the ponds suddenly in a single night and gradually return to summer hunting grounds far from the water.

The gelatinous masses left on the bottom of ponds swell and rise to the surface after a few days, and later sink 20 to 30 cm., where they hang suspended. From the size attained by the jelly-capsule surrounding each egg one may judge of the length of time the eggs have been laid. The eggs hatch after 6 to 19 days (about  $10\frac{1}{2}$  days in the terrarium, and  $12\frac{1}{2}$  to  $13\frac{1}{2}$  in the ponds outside). The larvæ form a jet-black mass on the egg-jelly, and then swarm about over it, and in two or three days scatter and hang attached by their adhesive organs to floating leaves and to plants. After a week their external gills are gone, and they have taken on the well-known "tadpole" proportions. The jelly floats about and dissolves away.

The tadpoles develop their hind legs in 55 to 60 days after hatching, when 38 to 44 mm. long; and both fore legs when 70 mm. long. They eat anything that is soft, chiefly decaying vegetable matter; are very fond of putrid veal, and thrive well on earthworms in a similar state. After 79 to 81 days, when 45 to 50 mm. long, the tadpoles transform into small frogs.<sup>1</sup>

These young frogs all leave the water immediately, and after a few days move away from the shores of the ponds to scatter abroad, each settling in some separate hunting ground, there to remain four years or more, till sexual maturity calls them back to their native pond.

At the first the young frogs are 15 to 20 mm. long; they grow to be 25 mm. long the first season, 30 mm. the second year, 50 to 55 mm. the third, 60 mm. or more the fourth, and 70 to 80 mm. the fifth, when they are sexually mature.

Kept in captivity they soon grow fat and dull (*i.e.*, tame), and furnish to careful observation some facts of interest to comparative psychologists, though it cannot be said that they give much evidence of high psychic activity.

Later, when these snakes were removed, the frogs no longer exhibited alarm at a stick. This snake seems to hypnotize the frogs so that they make no resistance but allow themselves to be swallowed, while they will flee from some other snakes. They seem also to recognize this enemy by its odor, if we accept the author's evidence.

They learned to come to a certain place to be fed at a certain time, and, after wandering about in the night time, came regularly back to some habitual resting place to spend the day.

They fed most voraciously, eating even hornets without great

<sup>1</sup> In one case all the eggs of a bunch were white and produced albino tadpoles, with dark eyes, however; but these became brown and changed into frogs but little lighter than normal.

inconvenience, and using their hands to force the ends of large earthworms into their mouths. They could be made to take meat and even carrion held on a needle before them. In this way the captive frogs were made much more fat and larger than those of the same ages outside.

Such overfed creatures developed a second period of sexual excitement in midsummer, but this led merely to certain males grasping the females for a short period.

Observations made in the neighborhood of Zofingen, Switzerland, and upon a frog not found here, may have no direct bearing upon the life history of our own frogs, but they indicate lines for imitation. With increasing interest in aquaria and gardens, both botanical and zoölogical, we may hope for more natural history work of this kind, and for the filling up of immense gaps in our knowledge concerning the length of life and rate of growth of animals.

E. A. A.

**Psychical Qualities of Ants and Bees.**<sup>1</sup>—The question as to whether or not we may ascribe psychical qualities to ants and bees is discussed by Albrecht Bethe in a recent issue of *Pflüger's Archiv*.

In his introduction the author points out the danger of an investigator's personality being read into the subject investigated, and also danger of the use of such words as carry with them meanings not warranted by the facts; men see, but all we know about bees is that they are influenced by light, and it would be unscientific to say they do anything so highly psychical as seeing until it is proved. It is absolutely impossible to find words which are always consistent with this idea, but the endeavor has been made to do so as far as possible.

The polymorphic colonies of bees and ants are pointed out as giving direct evidence against the Lamarckian principle of the inheritance of acquired characters. This polymorphism, Bethe believes, is completely explained through congenital diversity and natural selection, as is true also for all purposeful reflexes.

It is well in reading the paper to bear in mind the author's distinction between reflexes and instincts. "Only those actions can be designated instinctive in which an animal, which can be proved to possess psychical qualities, follows an inherited impulse without a

<sup>1</sup> Albrecht Bethe, *Dürfen wir den Ameisen und Bienen psychische Qualitäten zuschreiben?* *Archiv f. d. Ges. Phys.*, vol. lxx, Pts. i, ii, pp. 15-100, January, 1898.